

SCIENCE

NEW YORK, APRIL 1, 1892.

STORAGE OF STORM-WATERS ON THE GREAT PLAINS.

SOMEWHAT exaggerated expectations have been aroused by the speculations of certain theorists in regard to the possibilities of water storage on the high, wind-swept, treeless plains lying between the 98th meridian and the Rocky Mountains. These visionaries have virtually promised every farmer a reservoir on his land if he would only make the effort to secure it.

The need of storage, if it can be made a success, is indisputable. Rivers are few, and, as a rule, inadequate to the irrigation of more than the lands of their own valley. Artesian wells are limited to certain sharply defined basins. Other wells are generally too deep for profitable irrigation by pumping, except for small plats of fruit and garden vegetables. If the mesas are to be extensively irrigated it must be by storage of storm-waters. Can it be done? If there is any doubt about it we would better know the truth than to encourage delusive hopes. Let us seek some quantitative numerical expression for the possibilities and limitations of storage.

The great robber of moisture on the plains is evaporation. The activity of the winds is so great and constant that more vapor is raised from exposed water surfaces than in many regions of greater heat. The annual evaporation is seldom, if ever, less than four feet, and may rise to eight feet. We may safely put the average as high as five feet.

The rain fall varies from one to two feet. Its seasonal distribution is favorable, the late spring months and the summer months receiving the greatest amount. So far as the quantity and seasonal distribution of the rainfall are concerned the chances of impounding some of it look encouraging. But it is not so much the aggregate of precipitation as the percentage of it which flows off on the surface, which determines the feasibility of storage. In a treeless region of great evaporation and porous soil and subsoil, the total run-off is always low, and much of that is subterranean. Humphreys and Abbott, in their report on the Mississippi River, estimate the total run-off of the Missouri valley at 15 per cent of the rain fall. This includes the springs which feed the rivers, as well as the superficial run-off. This subterranean factor is unusually large on the plains, because there are large areas on the mesas and among the sand hills, which have no surface streams. All moisture reaching the rivers from these areas percolates beneath the surface, and the superficial run-off is by so much diminished.

Again, if the average for the whole Missouri valley is 15 per cent of the rain fall, it is less than that on the plains, because the whole basin includes wooded areas and steep mountain slopes, from both of which the run-off is more than the average. If we reckon 7.5 per cent as the superficial run-off of the plains, that will certainly be as favorable as the considerations just presented will possibly admit. It is more likely to be too high than too low, for fully half, if

not more, of the run-off is subterranean, and the total is less than 15 per cent, while we have allowed half of 15 per cent for surface flow which may be impounded.

The third important consideration is seepage. A reservoir may be made absolutely water-tight, but it is not likely to be. Rather is it absolutely certain that for small storage on the farm, executed without the aid of professional engineering, and under rigid conditions of economy, so that cementing, or puddling with clay, is out of the question on account of the expense, the loss by seepage will always be considerable. The possible variations of such loss are so great that we can do no better than to make a somewhat arbitrary assumption of its amount, say two feet annually. If the site is so badly selected, and the dam so poorly built, that the water will be lowered more than two feet annually by percolation, success is improbable; on the other hand, less than two feet would be too small a margin to allow for seepage under the circumstances. More would be fatal, and less is improbable.

The fourth consideration is the ratio of catchment basin to reservoir surface. This factor is more under human control than the others. At first blush it might be thought to be wholly a matter of choice. And so it is if the reservoir is artificially excavated. It may be dug deep and narrow to prevent evaporation. Its surface may be made only one-millionth of the catchment basin, if that is desirable. But the economy of water storage for irrigation will not admit of more excavation than that required to procure earth for the dam. Aside from the cost of digging it, a deep pit would require a pump to raise the water. Natural depressions must be utilized. But these are always broad and shallow on the uplands. Deep cañons and valleys are excluded because they are below the lands to be irrigated. They may answer for the valley lands below them, but not for the table-lands which we are considering. In the wide shallow basins of the uplands, if the waters have any considerable depth, they will spread abroad, cover much good land, and lose much by evaporation. But they must have considerable average depth throughout the year for two reasons. The maximum depth will occur after storms, the minimum during periods of drought. Unless the average is high it may readily happen that little or no water is available just when the crops need irrigation. Furthermore, the depth should be considerable, or else the reservoir will flood nearly as much land as can be irrigated from it. E. S. Nettleton, chief engineer of the Irrigation survey, U. S. Dept. of Agriculture, estimates that an annual average of nine inches of water over the whole surface of the field will be required for successful irrigation on the plains. One acre of reservoir with an annual average depth of four and one-half feet will therefore irrigate six acres of land. The value of the flooded land will absorb the profits of the operation if the ratio is greater than that, that is, if the depth of water is less.

It is evident that when water is impounded in natural depressions on the table-lands the reservoir will necessarily cover a considerable fraction of its catchment basin. Take

the proposition that every farm may have a reservoir, and see how it will figure out. For an average annual depth of four or five feet the water will spread over several acres, certainly not less than five acres. On a farm of 160 acres the catchment basin cannot be more than 32 times as large as the reservoir. Drawing from the lands of one's neighbors cannot be counted upon. Your neighbor below will be as likely to draw from your land as you are to draw from your neighbor above. The chances are even, and, in the general summing up of catchment areas, each can only count upon his own. Indeed he cannot count upon all of his own land, for, if it is all devoted to gathering and storing the water, where is the field to be irrigated? That must lie below the reservoir, as the catchment basin must lie above it. This simple matter of levels imposes another rigid limitation upon successful storage. Tillage of the catchment basin, causing greater absorption of the rainfall—possibly complete absorption of it—is another contingency which may defeat storage.

If the farmer owns a half section, 328 acres, and if we make due allowance for irrigated fields, and for slopes which face away from the reservoir, he may possibly get a ratio as high as 50:1. This is not enough for successful storage. On a section, 640 acres, it might be as high as 100:1, if the slopes were happily disposed. Instead, therefore, of a possible reservoir on every farm, it is clear that only very large farms having a favorable topography can enjoy this luxury. The ratio 100:1 probably represents the maximum of favorable conditions which can ordinarily be realized on the plains. Hence we need not consider the possible results of any higher ratio. Nor need we go below the ratio 50:1, since that is already below the requirements of successful storage.

It appears then that, instead of the ratio of catchment to the storage area being a matter of choice, it is subject to quite narrow limitations.

We set out to seek quantitative results. By using data given above for evaporation, run-off, and seepage, which are believed to be fairly good approximations to the actual values of those factors, we may construct¹ the following table:—

Table showing the annual average depth of water for ratios varying from 50:1 to 100:1, and for rainfall varying from one to two feet, the annual evaporation being five feet, seepage two feet, and the run-off 7.5 per cent.

Ratio of Catchment to Reservoir Sur- face.	Depth of Water for a Rainfall of				
	12 inches.	15 inches.	18 inches.	21 inches.	24 inches.
50:1	None.	None.	None.	None.	.5 ft.
60:1	"	"	"	.87 ft.	2. ft.
70:1	"	"	.87 ft.	2.19 ft.	3.5 ft.
80:1	"	.5 ft.	2. ft.	3.5 ft.	5. ft.
90:1	"	1.44 ft.	3.12 ft.	4.81 ft.	6.5 ft.
100:1	.5 ft.	2.37 ft.	4.25 ft.	6.13 ft.	8. ft.

This table must not be taken to mean more than was intended. "None" does not mean that a reservoir under the given conditions would not contain water at any time in the whole year. It might be full after a storm, yet the average expectation of finding water there at any date when it is needed for irrigation is correctly expressed by zero.

¹ The formula for computation is $\frac{R \times r \times r'}{100} - (e + s) = D$, in which R = rainfall, $\frac{r}{100}$ = run-off, r' = ratio of basin to reservoir, e = evaporation, s = seepage, and D = annual average depth of water resulting from the given conditions.

The table is intended merely for a quantitative expression of results which will follow if the assumed data are fairly correct. And, if they are somewhat erroneous, whoever knows a more accurate value for any factor can readily insert it, and correct the table. Quantitative expressions, even when based upon assumptions and hypotheses, are more instructive than vague and speculative generalizations. This table, for instance, shows certain limitations of water storage so narrow and rigid that any errors which are likely to be detected in the assumed data will not overcome them.

To specify some of these limitations, take the first column of the table. It means unmistakably that no storage can be made from a rainfall of one foot. The highest ratio, that of 100:1, a ratio which can seldom be realized, gives only six inches as the permanent average depth of water in the reservoir. None of the assumed data can very well be so far astray that its correction will raise the amount to a reliable irrigation head of water. Possibly full at one time, but dry as a powder-horn at other times, such a reservoir would be useless, because it would be unreliable. Certainty—that most valuable feature of farming by irrigation as opposed to an enforced dependence upon the fickle goddess of weather in the rain-belt—would be lost. The farmer must have the water just when he needs it, not just when it happens to come. The figures for average annual depth show the maximum which can be relied upon with certainty at any given date. While it might sometimes be greater, there is no rational assurance of it.

The seasonal distribution of the rainfall is so far favorable to a speedy use of stored waters, without serious loss by evaporation, as to make the case somewhat better than appears in the table. But over against this is the neutralizing consideration that the greater rainfall of spring and summer is more fully absorbed than the lighter precipitation of winter upon frozen ground. Melting snows yield a greater run-off than summer rains. This increases the average period of storage before use, and correspondingly diminishes the chances of success.

These changes are still too slender to be at all reliable if the rainfall is fifteen inches. Indeed, it is not until we come to the column headed "18 inches" that we find any encouragement. One result at the bottom of that column looks hopeful, but that calls for a catchment surface one hundred times as large as the reservoir—a condition which, when coupled with the further limitation of enough good irrigable land under the reservoir, not one farm in a hundred can fulfil.

The promising figures are twice as numerous in the next column, and three times as numerous in the last. But even with two feet of rainfall the chances of failure and success are about even. The ratio must be at least 75:1, or a mean between the lowest and highest in the table.

For areas having a greater rainfall than two feet, where the impounded waters might be useful for other purposes, but would hardly be needed for irrigation, the possibilities of storage may be easily discovered by extending the table.

Water storage upon the high mesas of the treeless belt is, if not wholly a delusion, at least somewhat delusive. More hopeful is the expedient of deep tillage, which is also a sort of storage. Hidden from sun and winds in the loose soil and sub-soil, the moisture will thus be preserved at the very spot where it is needed to sustain vegetation.

L. E. HICKS.

DR. BAILLON'S "Dictionnaire de Botanique," the publication of which was commenced in 1869, is now completed.

THE SOPHISTICATED FRENCH WINES.

LOVERS of the glass that is alleged to exhilarate with moderation, and more especially those whose glances melt at the sight of French labels, will be interested in a report recently made to the French Academy of Science by three celebrated chemists. Our California vintners, too, whose machine-made wines by a chemical miracle become five years old within ten days from the press, will also find something to interest them. The report was made *apropos* of a question submitted by the Paris Chamber of Commerce whether it was permissible to use the salts of strontium to precipitate the excess of plaster added to wine by vintners. The question was referred by the Academy to a committee composed of MM. Berthelot, Duclaux, and Gautier. These eminent *savants* made the following report:—

“For above thirty years the employment of plaster in the manipulation of wines has been general throughout the south of France. A recent law has decreed that the maximum quantity of sulphate of potassium per litre in merchantable wine shall be two grams, and therefore the wine trade demands a method for reducing the quantity of sulphate in wines on hand to the legal limit. Some of these have already begun to use for this purpose a mixture of tartrate of strontium and tartaric acid. These substances added in the right proportion cause the precipitation of sulphate of strontium and the solution in the wine of bitartrate of potassium. This operation replaces in the wine the tartrate of potassium removed by the plaster, but unfortunately the wine also retains in solution more or less of tartrate of strontium. This salt is not a normal constituent of wine. It is not found in any food-stuff, though it exists in some mineral springs, as, for instance, those of Vichy. When pure, these salts are not believed to be poisonous in ordinary doses.

“The question submitted by the Chamber of Commerce includes in effect a question of principle and one of fact. In principle one might say that, wine being a natural product, the addition of any chemical substance whatever should be looked upon as a falsification, more especially is this the case when the purpose of the substance added is to mask the real character of the wine and deceive the purchaser as to the real nature of the merchandise he purchases.

“Moreover, it appears to the committee that to furnish the Chamber of Commerce with a method for deplastering wines will in effect throw the authority of the Academy in favor of plastering, and will, furthermore, seem to promise a further scheme for destrontianizing the wine, to use a neologism, and so on, *ad infinitum*.

“It is necessary to define clearly the point where wine ceases to be a natural product and becomes a chemical fabrication. It is to the interest of no one, either among the vintners or among the merchants, to furnish grounds for proclaiming to the world that French wines are artificial products made, not by vintners, but by chemists. The authority of the Academy cannot be used for any such purpose. So much for the question of principle; now as to the facts: Though strontium may not be a poison in ordinary doses, and even though it may serve as a useful medicine in certain cases, it is by no means certain that when used in sensible doses, as it must be if it becomes a constituent of an alimentary substance in such common use as wine, it will be without effect upon the bodily functions. It is necessary to be not merely prudent but even timid in deciding whether or not to introduce into the bodily circulation mineral elements which normally do not exist there. Such substances, even when apparently innoxious at first, may by their accumulation in

the body produce at length very grave consequences. What may be innoxious to some persons may be ruinous to others, according to temperament or pre-existing maladies. The experiments of M. Soborde have shown that tartrate of strontium may produce congestion of the kidney in animals. Still, further, it must be remembered that therapeutic experiments with strontium have been conducted with a chemically pure salt. The strontium of commerce is always more or less mixed with salts of baryta, which are not easily separated, and which are very poisonous. The danger would be very great were these salts to become articles of ordinary commerce, to be used without discrimination or control by vintners and wine merchants. These would buy their supplies in the cheapest markets without regard to purity. We know, too, how difficult it is to use such substances in such exact proportions as to get just the desired reaction among the elements employed.

“For these reasons the committee recommends that the Academy reply to the Chamber of Commerce that it declines to approve of the employment of salts of strontium for deplastering wines, and reprobates such practices.”

At a subsequent sitting of the Academy M. Quantin contributed the result of a study of deplastered wines. The process of deplastering is used only for the purpose of reducing the contents of the wine in potassium sulphate to the legal limit. M. Quantin found in the course of his researches that not only are the chloride, nitrate, and carbonate of baryta commonly used, but also that the tartrate, acetate, and phosphate are employed for this purpose.

M. Berthelot, in discussing M. Quantin's paper, said that the facts brought to light by M. Quantin's researches bore a character of very grave interest. The deplastering of wines by means of the salts of baryta was not merely a method of falsification of a common alimentary substance, but a real, wholesale manufacture of poisons.

GERALD MCCARTHY.

North Carolina Experiment Station.

A BOTANICAL LABORATORY.

FORMERLY the botanical laboratories were given up almost entirely to systematic and structural work, this being as much a matter of necessity as of choice, for the physiological and bacteriological work are comparatively new branches of the science of botany, requiring specially designed apparatus, which is often very costly. Of late years, however, the great scientific and economic value of the latter subjects is being realized, and laboratories are being equipped in which these lines can be pursued.

One of the finely furnished physiological and bacteriological laboratories of this country is that at Purdue University Experiment Station, La Fayette, Ind., equipped by Dr. J. C. Arthur. The laboratory consists of five rooms beside the greenhouse, these being a general laboratory in the centre, a library and herbarium to the west, a bacteriological room to the east, and a store-room and dark room to the north. The general laboratory has a large window, occupying nearly the whole width of the south side of the room, furnished with light lower curtains and a dark heavy upper one. These can be adjusted so as to tone the light on a bright sunny day, and allow the entrance of all the light possible on a gloomy day. In front of the window is a long table fastened to the wall to prevent vibration as much as possible; this is used for microscopic work. The walls are lined with wall cases and cases of drawers for reagents,

glass-ware, and apparatus in immediate use. There are tables with gas and water supply; a sink with hot water apparatus and cleated shelves for drying purposes; and drying and constant-temperature ovens. Accompanying the reagent case is a card catalogue, which indicates very nearly the arrangement of reagents, so that the time taken to find one is reduced to the minimum.

Among the pieces of apparatus in the room are auxanometers, clinostats, electric and mercuric thermo-regulators, hot stages, dialyzers, pressure regulators, chemical, torsion, and ordinary balances, dynamometers, an electric motor, transpiration tubes, etc.

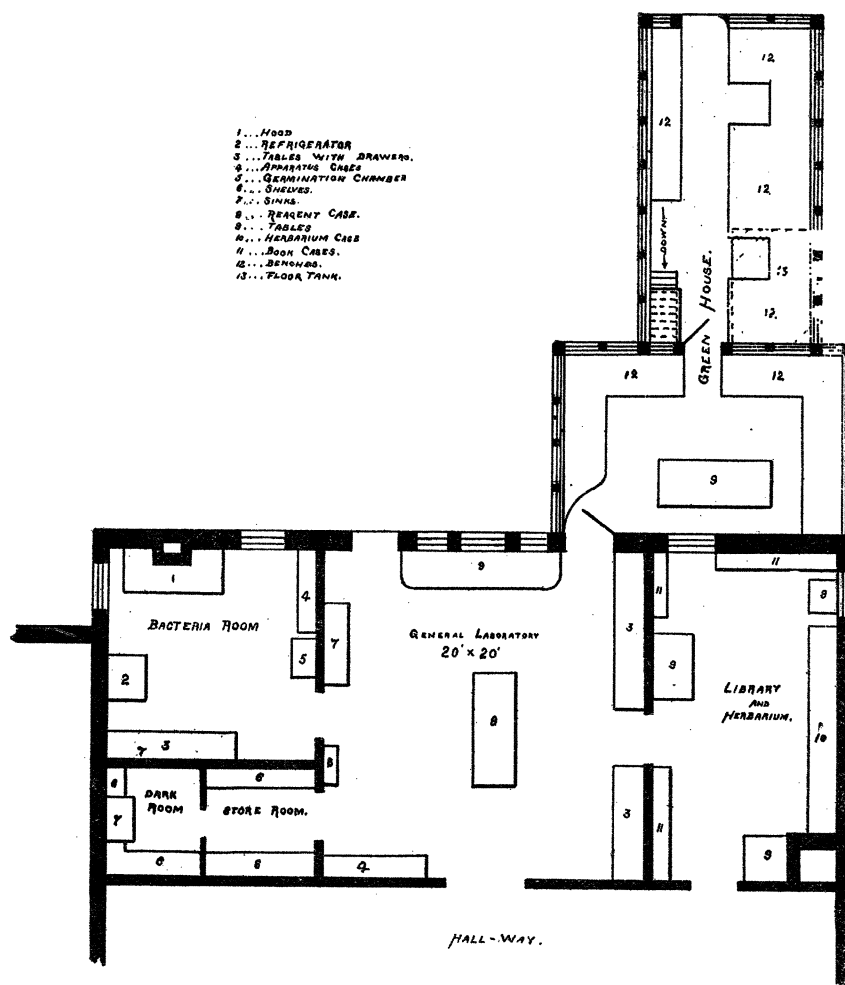
The bacteriological room has a south and east light, and is

fungi, and physiological subjects. The library is carefully catalogued.

The herbarium contains both phanerogams and cryptogams, parasitic fungi being specially well represented.

In the store room are kept the supplies not in immediate use. Leading from the store-room is the dark room for photographic work; this room being supplied with gas, water, a specially arranged sink, and the chemicals and appliances needed in the work.

A small greenhouse extends south from the station, its main room opening directly from the laboratory and on the same level. This room is fitted up with tables and benches upon which apparatus can be placed when the student is



fitted up with the latest appliances; such as steam and dry-air sterilizers, germination ovens, bulb and ordinary culture tubes, and all the various paraphernalia used in bacteriological work. There is a large table with sink, having a water supply, and cases of drawers for supplies of cotton, agar, gelatine, cages, etc., a case of stains, and a large hood with water supply in which the steam sterilizers are placed.

The library and herbarium on the opposite side of the general laboratory to the bacteriological room contains the standard works, and as Dr. Arthur's private library is kept here besides, there are many valuable and rare works to which one does not usually have the good fortune to have access. There is also a good supply of botanical journals both in English and foreign languages. The library is specially well supplied with works on plant diseases, parasitic

working with the living plants. The smaller room is on a lower level, and is kept at a lower temperature than the main room. Experiments can thus be carried on with plants at different temperatures. There are also in this room a floor tank for aquatic plants, and steam-heated cutting beds. Both rooms are heated by steam. The greenhouse forms a very useful adjunct to the laboratory.

The laboratory in the Station is entirely separate from the University laboratory, the latter being under the direction of Dr. Stanley Coulter; the work there is in systematic and structural botany. The students in Dr. Arthur's laboratory who do the physiological and bacteriological work are juniors and seniors who have elected botany and have done the systematic and structural work previously. There are also post-graduate students who are doing original work.

KATHERINE E. GOLDEN.

THE DISTRIBUTION OF FISHES.

A GOOD illustration of the amount of change brought about by deep-sea investigations in our ideas of the distribution of the fishes is to be seen in the recent history of the Discoboli. A short time ago it was supposed all the representatives of this group — the Discoboles, disk-bearers, lump-fishes, sucking-fishes, or sea-snails, as they are variously called — were restricted to the Atlantic and Pacific, in their northern parts, and to the Arctic Ocean. This was previous to 1870. At that date species were known of each of the families of the group. From the Atlantic section there were two species of the Cyclopteridæ — *Cyclopterus lumpus* and *Eumicrotremus spinosus* — and five species of the Liparididæ — *Liparis montagui*, *L. liparis*, *L. tunicatus*, *Careproctus major*, and *C. Reinhardi*. And from the Pacific the list contained one species of the Cyclopteridæ, *Eumicrotremus orbis*, two species of the Liparopsidæ, *Cyclopterichthys ventricosus* and *Liparops stelleri*, and five species of the Liparididæ — *Liparis mucosus*, *L. calliodon*, *L. Agassizii*, *L. pulchellus*, and *Careproctus gelatinosus*.

Between 1870 and 1891 the additions from the Atlantic were four species of the Liparididæ — *Careproctus micropus*, *Paraliparis bathybius*, *P. liparinus*, *P. membranaceus*. In this period the northern Pacific had yielded one species of the same family, *Paraliparis rosaceus*. But the more important additions in this time were from the southern end of the American continent, whence came one species of the Liparopsidæ, *Cyclopterichthys amissus*, and three species of Liparididæ — *Liparis antarctica*, *L. Steineni*, and *L. pallidus* (one or more of which may yet prove to be young of *Careproctus*). Previous to 1891 this was the state of our knowledge of the Discoboles; and the generally accepted idea of their distribution limited them to the far-north and to the far-south, and displaced them in the tropics by other disk-bearers belonging to very distinct families, the Gobiidæ and the Gobiiesocidæ. As such a number of the Discoboli were deep-sea forms, and as the anatomy in general was that of types adapted to a life far below the surface in low temperatures, there seemed to be no reason for supposing them absent from great depths under the torrid zone. These considerations induced me, in monographing the group for this museum, to predict that eventually the proper distribution would be found to extend from the northern to the most southern localities on the sea bottom (Mem. Mus. Comp. Zool., XIV., No. 2).

Since 1890 a new genus, *Cyclopteroides*, and new species have been added to the number of Discoboles known from the North Pacific. They, however, did not affect the distribution previously determined. It remained for the United States Fishery Commission steamer "Albatross," under Commander Tanner, to supply what was needed to verify the prediction. Among the fishes collected by this vessel while dredging off the west coast of Central America, in charge of Professor Alexander Agassiz, I find representatives of two species which place the sub-equatorial distribution beyond question. These specimens were secured within four degrees of the equator, at depths of more than 1,700 fathoms, in temperatures of about 36° F. They are figured and described in the forthcoming report on the fishes of these explorations, under the names *Careproctus longifilis* and *Paraliparis fimbriatus*. By their capture the Artarctic are connected with the Arctic localities, and the range of the Discoboli is proved to be one of the most extensive among the fishes, though the affinities and habits of those we now know are such as indicate that the present list of the species lacks much of being complete.

But the modifications of our ideas by deep-sea exploration, as will be shown in a later writing, are not confined to a particular group. Our conclusions respecting numbers of the families with which we had supposed ourselves well acquainted have been affected directly, through new species and extended ranges, and indirectly, through peculiarities of anatomical or other relationships that appear as evidences of the existence of allied forms not yet known, and of yet to be discovered centres of distribution serving as sources of replenishment for the fisheries, retreats for recovery from depletion, or as possible new grounds for our fishermen.

S. GARMAN.

Museum of Comparative Zoology, Cambridge, Mass., Mar. 7.

NOTES AND NEWS.

A NEW "Jahrbuch der Chemie" is to be issued by the German publisher, H. Bechhold, Frankfurt. It will be edited by Professor R. Meyer, who has secured the co-operation of many eminent men of science. The intention is that the progress of pure and applied chemistry shall be recorded every year in a connected series of articles.

— Japan has no fewer than 700 earthquake-observing stations scattered over the Empire, and the Tokio correspondent of the *London Times* is of opinion that they are all needed. He points out that not only are the Japanese shaken up by fully 500 earthquakes every year — some of them more or less destructive — but at intervals there comes a great disaster, amounting, as in the earthquake of Oct. 28, 1891, to a national calamity. Japanese annals record twenty-nine such during the last 1,200 years.

— The volcano of Kilauea is very active at present. The cavity produced by the last breakdown has not filled up, but there is an active lake two or three hundred feet below the general level of the floor and a quarter of a mile in diameter. Rev. S. E. Bishop of Honolulu says the whole plateau of Halemanman is steadily rising. It is evidently being pushed up by lava working underneath and not built up by overflows. Professor W. D. Alexander, in charge of the Trigonometrical Survey, writes that his assistant, Mr. Dodge, will probably re-survey the crater during the coming summer, for the purpose of comparing the present topography with that delineated in *Science*, vol. ix., p. 181, 1887. The Volcano Company is constantly improving the facilities offered to visitors for inspecting the crater.

— It sometimes happens that peat bogs swell and burst, giving out a stream of dark mud. Herr Klinge, as we learn from *Nature*, has made a study of this rare phenomenon (*Bot. Jahrb.*), of which he has found only nine instances in Europe between 1745 and 1883 (seven of these being in Ireland). Heavy rains generally occur before the phenomenon, and detonations and earth vibrations precede and accompany it. The muddy stream which issues, of various fluidity, rolls along lumps of peat, and moves now more quickly, now more slowly. After the outbreak, the mud quickly hardens, and the bog sinks at the place it appeared, forming a funnel-shaped pool. The bogs considered by Herr Klinge have been almost all on high ground, not in valleys. He rejects the idea that the effects are due to excessive absorption of water by the bog. The peat layers, which often vary much in consistency, have each a certain power of imbibition, and the water absorbed does not exceed this limit. Excessive rain affects chiefly the upper layer not yet turned into peat and the cover of live vegetation, which gets saturated like a sponge, after which the water collects in pools, and runs off in streams. The theory of gas explosions is also rejected; and the author considers the real cause to lie in landslips, collapses, etc., of ground under the bog, permitting water or liquid mud to enter. This breaks up the bog mechanically, mixes with it and fluidifies it, and an outburst at the surface is the result. The limestone formations in Ireland, with their large caverns and masses of water, are naturally subject to those collapses, which, with the vibrations they induce, are more frequent in wet years. The heavy rains preceding the bog eruptions are thus to be regarded as only an indirect cause of these.

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THE PATENT OFFICE BUILDING.

WE have recently referred to the condition of the United States Patent Office as revealed by the reports made at the meetings of the Association of Inventors and Manufacturers. It will be remembered that it was stated that either a new and much larger building is required for the work of that department of the Government, or a great extension of the present building and quarters. Every commissioner of patents for many years past has endeavored to bring this matter before Congress in such manner as to secure some relief, but without avail; and the condition of things in the building has now become, in consequence of the supineness of those responsible for it, as testified by the speakers in the discussion in the Senate reported in part below, something shameful and almost indescribable. It will be remembered also that the Patent Office building was erected many years ago, and especially for its present uses, at a cost of about \$3,000,000, all furnished by the inventors of the country; but it is now so utterly inadequate to its work that clerks and other officers in the office are actually in danger of asphyxiation. But this is not all; this building, built with the money of inventors thus taxed for the privilege of making this country the most prosperous and wealthy on the globe, money contributed by poor inventors usually, is not now even permitted to be appropriated to the use for which it was constructed or the purpose to which it was dedicated; but the Interior Department, organized since the formation of the Patent Office, has been permitted to enter its "camel's nose" into this tent, and has now succeeded in getting so much of its body in that it actually dispossesses the rightful proprietors, and it has even been suggested by at least one secretary of the interior that the Patent Office be dispossessed entirely.

The Patent Office rightfully owns the building, which is paid for out of its own earnings at a cost of \$3,000,000, and the accumulations of inventors' money in the treasury

amount to about \$4,000,000 more; nevertheless, it seems next to impossible to save the business of the country from further serious expense and enormous embarrassment through delayed cases, or to preserve the employees of the government from danger to health and life by the construction of a new building which might be, and should be, immediately constructed. It seems unfortunate enough that the present state of affairs should exist; but it seems doubly so when it is considered that poor inventors taxed for the benefit of a country which they have done so much to aid are not permitted to even build for themselves a building in which their work can be carried on in a business-like way, promptly and efficiently and at their expense. We quote from the *Washington Star*:—

"There was an interesting debate on local public buildings in the Senate yesterday afternoon. Senator Carey offered a resolution, which was printed in *The Star*, in which the committee on public buildings and grounds was called upon to report upon the condition of government buildings, the necessity for new buildings, the probable cost of the latter and the amount now annually spent for rent by the government.

"Senator Allison stated the rental expenditure as about \$140,000 per annum. He did not object to the inquiry, but he thought it would do very little good. Everybody knew that public buildings were needed.

"Senator Hawley made several pertinent and forceful remarks as to the structurally dangerous and generally unhealthy condition of the government printing office.

"Senator Platt talked pointedly of the Patent Office. Said he: 'It is now at least eight years since I called the attention of the Senate to this matter. The difficulty has been increasing ever since. Although we have been taking business out of what is known as the Interior Department building, the danger, the overcrowding, the unhealthiness of that building have been increasing all the time, notwithstanding the room that has been made for the Patent Office. I said then, and I repeat now, that if there was a factory in the State of Connecticut where the employees were obliged to work under as unfavorable conditions as to health as the clerks in the Patent Office, the proprietors would be prosecuted and convicted under the laws of the State of Connecticut.'

"Senator Gray had been looking into the matter also. 'I had occasion,' said he, 'as a member of the committee on patents of this body, to visit the portion of the Patent Office building to which are assigned the documents and records which have made the tremendous weight that is jeopardizing the safety of that building, and though I expected to find some inconvenience there and a state of things which was very undesirable, I was not prepared to see what was exhibited to me, and I have felt ever since that there was a personal responsibility resting upon every member of this body and upon the co-ordinate body of Congress as long as that state of thing continues for the lives as well as for the health of those people who are compelled to labor there for their daily sustenance. I found a room there in which seventy or eighty ladies were performing their clerical duties, that was so stifling that a half-hour's visit to that room made me so glad to get into the fresh air that I should be very unwilling to go back there again and stay the same length of time.

"While we are waiting for the fire-proof building referred to, there is danger that some of these people may be asphyxiated in the interval, and I think, among all of the important

questions that are pressing upon the attention of Congress, there is none more important and exigent than attention to this matter which has been brought up by the senator from Connecticut. I do not believe we can afford to wait a single day in giving our attention to some method of relief. I understand from the report made by the secretary of the interior that the quantity of air to each individual in the part of the building where these ladies worked is about 400 cubic feet, whereas Dr. Billings, the best authority perhaps in the United States or in the world on sanitary matters of this kind, says that human life cannot be healthfully continued without something like 4,000 cubic feet to the individual. I asked the gentleman who has charge of that room how they managed to get along at all, and he said that at intervals of about two hours or an hour and a half they had to ask all these people to go out of the room — in winter time, of course — so that they might raise the windows in order to change the air; otherwise they could not get along as well as they do. That condition of things is shameful as well as deplorable, and I think some action ought to be taken at once in the interest of the human beings who are compelled by their necessities to perform their duties under such circumstances.' ”

THE STRUCTURE OF THE HEMIPTEROUS MOUTH.

Our knowledge of the mouth parts of the Hemiptera is given by Professor Comstock in his valuable “Introduction” as follows: “The mouth parts are formed for piercing and sucking. Without dissection they usually appear as a slender, jointed beak, arising at the base of a shorter, pointed labrum. This beak consists of four bristles inclosed in a fleshy jointed sheath. Two of the bristles represent the

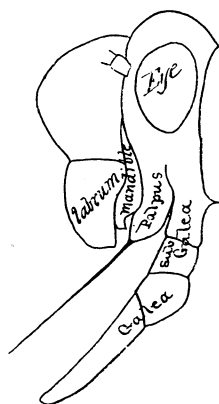


FIG. 1.

mandibles and two the maxillæ. The sheath is supposed to consist of the labium and grown-together labial palpi. This sheath is usually four jointed, and is never composed of more than that number of segments. The maxillary palpi are wanting.” The results of my studies in the Diptera, Hymenoptera and on the pupa of Cicada, lead me to disagree with this explanation, or homology, of the parts.

The head of a Cicada pupa when softened and cleaned so that all the parts are easily recognizable, shows four divisions, or sclerites, forming the lateral margin of the head inferiorly. In Fig. 1 the sclerites are shown, pried apart for convenience of recognition, and without attempt at any but diagrammatic result. The anterior of the sclerites is the labrum, covering the base of the mouth, and normally appressed so close to the beak that the intervening structures are

not visible. Behind the labrum and normally closely united to it is the mandibular sclerite, which has not been heretofore recognized, but which is exactly where it should be, compared with a mandibulate mouth. From the side this sclerite gives a mere indication of its character and from the firmness of the union shows that the mandibles are not mobile and therefore not functional. Cutting along the posterior suture of the mandible and then straight across so as to get

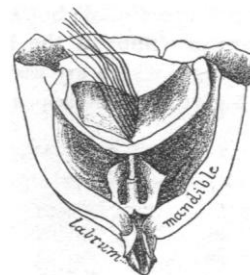


FIG. 2.

the whole of the labrum, we get from behind the view shown in Fig. 2. Here the mandibles show as elongated flattened strips, quite chitinous in texture toward the tips, which latter are acute and somewhat beak-like, divergent. The extremities lie so close to the pointed tip of the labrum that they are invisible from the side. In the cavity between the mandibular sclerite and the front of the labrum there is at least one large gland, probably that secreting the irritating fluid which many bugs inject into the punctures made by the beak. From this gland a distinct duct leads to the pointed

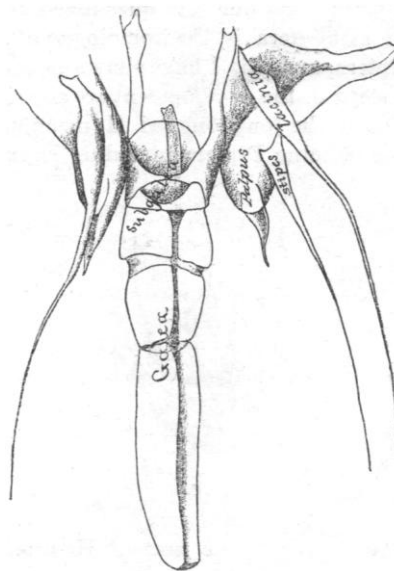


FIG. 3.

tip of the labrum behind and between two chitinous wings giving muscular attachments. In *Belostoma* the labrum is extended so as to cover the beak for half its length. Here there is a salivary gland behind the clypeus, the duct extending to the tip of the labrum and then apparently discharging into the beak. In some species the labrum is set inwardly with a coating of very fine, dense hair, giving a velvety surface, and this, as Dr. Packard has shown is the epipharynx. It is not present in the Cicada pupa. The sclerite next behind the mandibular ring is that from which arise the two bristles that are usually homologized with the mandible and

maxilla. That neither of them can be mandible follows from the fact that I have already demonstrated the true mandible. Removing the front rings altogether and spreading out flat the two posterior sclerites after removing the internal structures, we have the appearance shown in Fig. 3. In this figure we see the intimate connection between the beak and the maxillary structures. The two bristles are seen to arise from one base, and attached to the same source is the remnant of the maxillary palpus. The organ is much reduced, and probably not functional; but there is no doubt of its nature. By the pressure applied the base of the bristles is torn from the fastenings, which are distorted out of recognition. Figs. 4 and 5 give the true appearance. These two

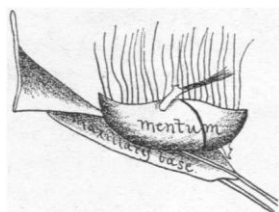


FIG. 4.

bristles represent the lacinia and stipes of the maxilla, developed in exactly the same way in which they are seen in the Diptera. In most species they are quite strongly modified at the tip and there is a permanent distinction in the character of the armature of the two bristles which will be of assistance ultimately in distinguishing the parts.

The remaining maxillary part, the galea, I identify with the beak, denying thus its character as labium and grown-together labial palpi. No one has questioned the fact that the beak in the Hemiptera is the homologue of the similar structure in Diptera, and this I have shown is a galeal development. The steps in the development are clearly shown by studying a series of the long-tongued Hymenoptera in connection with the piercing Diptera including *Erax* and allies.



FIG. 5.

Exactly how the change to the normal Hemipterous structure occurred, I have not yet been able to ascertain. In this view the basal segment of the beak through which it is attached to the other maxillary parts, represents the cardo; the second joint the subgalea; while the third and fourth represent the two joints of the galea. In the apparently three-jointed beak the basal segment is so intimately connected with the head that it seems to form a part of it. Dissecting away all tissue from the head and leaving only the cardo of the maxilla and the other internal mouth structures attached thereto, we have the appearance from behind shown in Fig. 5. Centrally there is a boat-shaped structure, on either side of which there is a flat chitinous plate with two leaf-like membranous processes attached. On each side of this central plate, and imbedded in the tissue, is one of the

lancets. Seen from the side, as in Fig. 4, the boat-like form of the central organ is more obvious as are also the maxillary base and the lancets issuing therefrom. This boat is formed of two parts closely united along a suture which is parallel to the line of the suture separating the labrum, the anterior portion belonging in the cavity behind the labrum, the remainder belonging to the central head cavity. That portion of the process belonging in the frontal portion of the head is shown in Fig. 2 superiorly. Through the centre of this boat on the inside is a thin membranous plate, longitudinally furrowed in its centre, and from this central furrow sending up long flat filaments, the nature of which I have not recognized. This boat-shaped process I homologize with the mentum in mandibulate insects, the fulcrum of the Diptera. It is all that remains of the labium or second maxilla, if my interpretation of the structures is correct. Exactly at what point in the development the missing structures were lost, I cannot yet say; it will require close study in groups in which I have as yet no material at all. I am confident, however, that the above explanation of the homology of the structures will prove the true one.

JOHN B. SMITH.

Rutgers College, N. Y.

THE ETYMOLOGY OF THE TWO IROQUOIAN COMPOUND STEMS, -SKĒⁿ-RA-KEQ'-TE' AND -NDU-TA-KEQ'-TE'.

STUDENTS of Iroquoian terms have made attempts to analyze these two interesting compound-stems, but in making these analyses they overlooked the force and exact meaning of the component elements of these two stems, and so the etymologies they have put forth are erroneous. Too much weight was given to so-called "accepted authority," and indiscriminating compilation took the place of careful research.

It appears from the evidence of language that hitherto all students who have attempted to analyze these two compound terms have been misled by a mistranslation of the noun *Gaskenra*, made by Father Bruyas in his work mentioned below.

The writer will here cite what has been written by him upon the two stems in question as well as what has been written upon them by other authors who have had access to his writings. This is done for the purpose of showing to what extent Bruyas's erroneous translation has been an embarrassment to all his copyists; for they invariably quote his wrong definition of the noun in question, and yet make remarks, the reasons for which should have led them to the true etymology and signification of the elements and terms in question.

Father Bruyas¹ succinctly says, "*Gaskenra*, la Guerre. Inde *hoskenragetete*. S. 2ae conj. soldat." Again, on page 83 of the same work, he writes, "*OnnSta*, coton, duvet." And immediately below this, "*NondStage^{te}*, la Guerre. *HotinnondStage^{te}*, les soldats."

Father Cuq, following his predecessors in Iroquoian glottology, writes,² "*Oskendra*, vieux mot qui n'est plus guère usité qu'en cp. avec le v. wakkehte, porter. Il devait signifier la guerre ou plutôt qq. instrument de guerre. Roskenrakehte, au pl., rotiskenrakehte, homme de guerre, guerrier, militaire, homme portant armes." This citation may be translated thus: "*Oskendra* [is] an old word which is not much in use now except in composition with the verb wak-

¹ "Radices Verborum Iroquæorum," Neo-Eboracⁱ, 1863, p. 98.

² "Lexique de la Langue Iroquoise," Montreal, 1882, p. 36.

kehte, to carry. It must have signified war, or rather some instrument of war. *Roskenrakehte*, *rotiskenrakehte* in the plural, a soldier, warrior, martial man, man bearing arms." Again, on page 35 of the same work, we find, "*Onota*, jonc," i.e., *Onota*, "a rush or reed," being the *onnsta* of Father Bruyas.

Following M. Cuoq, Mr. Horatio Hale says,¹ "*Oskenra* is an ancient word for war. *Kakehte* is to carry. The compound word, *roskenrakehte*, means 'one who carries on war.'"

Lafitau, although clearly pointing out the true origin of the two compound stems in question, fails to deduce from it the exact etymology of either stem. He was evidently misled by the mistranslation of *gaskenra* by la guerre, war, made by Father Bruyas, as cited hereinbefore, for *ka-ske*² "*ra*" does not signify war. Before making an analysis of the terms at issue, the writer will here quote at length what Lafitau has written upon them. He says,³ "Les Iroquois et les Hurons, nomment la Guerre *n'Ondoutagette* et *Gaskenrhagette*. Le verbe final *Gagetton*, qui se trouve dans la composition de ces deux mots, et qui signifie Porter, marque bien qu'on y portoit quelque chose autrefois, qui en étoit tellement le symbole, qu'elle en avoit pris sa denomination. Le terme *Ondouta*, signifie, le duvet qu'on tire de l'épy des Roseaux de Marais, et signifie aussi la plante toute entière, dont ils se servent pour faire les nattes sur quoi ils couchent, de sorte qu'il y a apparence qu'ils avoient affecté ce terme pour la Guerre, parce que chaque Guerrier portoit avec soy sa natte dans ces sortes d'expéditions. En effet la natte est encore aujourd'hui le symbole qu'ils représentent dans leurs peintures Hieroglyphiques pour désigner le nombre de leurs campagnes. Pour ce qui est du terme *Gaskenrha*, il est si ancien que les Sauvages eux-mêmes n'en savent plus la signification. Mais comme il seroit inutile de courir après des étymologies, sur lesquelles les naturels du pays sont embarrassés eux-mêmes, il me suffit de dire, que tout ce que les Sauvages portent dans leurs courses militaires, se réduit à leurs armes, à quelques ustenciles nécessaires dans les campemens, et à quelques provisions de farine préparées de la manière, dont je l'ai expliqué." This quotation may be rendered thus: "The Iroquois and the Hurons call war *n'Ondoutagette* and *Gaskenrhagette*. The final verb *Gagetton*, which is found in the composition of these two words, and which signifies to bear or to carry, shows, verily, that heretofore something was borne to it [i.e., to war] which was a symbol of it [i.e., of war] to such a degree that it [war] had assumed its [the symbol's] designation. The term *Ondouta* signifies the down [the wool-like substance] which is taken from the ear [cat-tails] of marsh-reeds, and it also denotes the entire plant, which they use in making the mattresses (nattes) upon which they lie, so that it appears that they applied this term to war, because every warrior, in this kind of expeditions, carried with him his own mattress. In fact, the mattress is still to-day the symbol employed in their hieroglyphic picture-writing to denote the number of their campaigns. As to the term *Gaskenrha*, it is so old that the Savages themselves no longer know its meaning. But as it would be profitless to run after etymologies concerning which the natives of the country themselves are perplexed, it suffices me to say that the entire equipage of the savages in their military expeditions consists of their arms, of some necessary utensils for the encampment, and of some provision of meal prepared in the manner which I

have explained." Again, on page 46 of the same Tome, while discussing the monogrammatic or hieroglyphic picture-writing of the Indians, Lafitau says, "Le nombre des expéditions est designé par des nattes. On distingue celles où il s'est trouvé, et celles où il a commandé, en ce que ces dernières sont marquées par des colliers attachés à la natte." This citation may be rendered thus: "The number of expeditions is denoted by mats or mattresses (des nattes). There is a distinction made between those wherein one was merely a member and those wherein he commanded, in this, that the latter are designated by having wampum-strings attached to them."

It is only by a figure of speech,—by metaphor,—that either one of the compound stems, *n'Ondoutagette* or *Gaskenrhagette*, signifies war or warfare, for neither of the component nouns of the two stems is denotive of war, nor does the verb-stem with which they are compounded signify warring or to make war.

In the following lines, the alphabet used in the orthography of the Iroquoian terms and stems, other than those quoted, is that of the Bureau of Ethnology, Smithsonian Institution.

The verb-stem *-keq-te'*, although having the form of the perfect tense of a simple verb, the present tense form of which is now not in use (being no longer a living form of the verb), has the force and meaning of a present tense; and it is for this reason that its personal or pronominal affixes are those of the perfect tense of regular verbs. It has a specific meaning only; namely, to bear or rather bearing [something] on the back [by means of the forehead strap]. Hence, for the purposes of etymology, to translate it simply by such general terms as "to bear," "to carry," and "to carry on," is a mere waste of time and a confession of the ignoring of its only and specific meaning which requires its composition with such nouns of things only which may be borne on the back. Indeed, the name of the forehead-strap, *ka-keq'-ta'*, is derived directly from it, the initial *ka-* being only a gender sign, and the final *-a'* a nominal formative.

In the compound stem *n'Ondoutagette*, cited by Lafitau, the initial *n* and apostrophe are used for the definitive *ne* pronounced as a proclitic. The noun in it is *on-du'-ta'* (*Ondouta*), which signified a reed or rush, the material for mat and mattress-making; the down, or cotton, of reeds, rushes, and plants; and, lastly, the war-mattress or war-mat.

To confirm what has been advanced in support of the writer's definition of the word *on-du'-ta'*, he will cite what is found in the "Huron Grammar" of Père Pierre Potier, dated about 1750. Therein are to be found the following entries, "*kandôta*, jonc à nattes," i.e., reed or rush for mats; again, under "Meubles d'une Maison," is to be found "*on-dôta*, natte de guerre, i.e., war-mat or war-mattress. This is conclusive evidence as to the early meaning of *on-du'-ta'* as pertaining to warfare. Hence, *on-du-ta-keq'-ta'*, the participial form, signifies, etymologically, 'bearing a war-mat or mattress on the back.' Replacing the initial gender-sign *o-* by the masculine pronoun of the singular third person of the anthropic gender, *ho-*, he, we have *hon-du-ta-keq'-te'*, "he bears a war-mattress on the back," which was one of the customs of warriors on the war-path.

It has been said elsewhere in this article that *ka ske*² "*ra*" (*Gaskenrha*) did not mean warring or warfare. Lafitau states, in the citation from his work above quoted, that, in his time, its meaning was unknown to the Indians themselves. But, misled by Bruyas's mistranslation of it, he

¹ "Transactions of the Buffalo Historical Society," vol. 3, p. 72.

² "Mœurs des Sauvages Amérindiens, Comparées aux Mœurs des Premiers Temps," Tome II., 194-5 pp. Paris, 1724.

doubtless asked them if the word meant war, and, receiving a negative reply, he at once inferred that as it must be an archaic word for war its signification had been forgotten by the Indians; for was it not still the component element in a compound meaning war and warrior? This inference, however, was erroneous.

Since it is compounded with the verb-stem *-keq-te'*, it must like *on du'-ta'* signify something which had to be borne on the back by the warrior. Under the heading, "Meubles, mesnages, outils," i. e., "Family or household goods, tools, etc.," Fr. Gabriel Sagard, in his "Dictionnaire de la Langue Huronne" (1632), wrote "Ballet, *Oscoera*." In the fifth edition of the "Dictionnaire de l'Academie Françoise," Paris, 1825, there are two forms of the word "ballet" given; one of these is "balle," signifying a large pack of goods, bound with cords, and wrapped in coarse linen cloth, and the other is "ballot," meaning a large pack or bundle of family or household goods. The word bale is evidently the correct rendering of this word. But it is very improbable that a bale as such formed a part of the family and household goods and tools of the early Hurons. It is likely, however, that *oscoera* signified a mat woven from the common Indian hemp (Apocynum Cannabinum), and thus merely a form of the modern Mohawk, and perhaps proethnic, *oska'ra'*, flax, hemp, tow, the Tuskarora form of which is *u'-ska-rë*, meaning shawl, blanket, bedding, bed-cover, whatever is spread to lie upon; being found in *yä-čka-re n'-kua'*, "one uses it to spread," which is a descriptive name of a carpet. Father Bruyas (on page 115, op. cit.) has "*Gentskaron*, estendre, mettre la natte," i. e., to spread or lay the mat or mattress; and "*Gentskare*, S. natte, avoir une natte," i. e., a mat, to have a mat, mattress. Père Pierre Potier (op. cit.) has "*kaskara*, tout ce qui sert à coucher," i. e., all that which is used for bedding. It is thus seen that the noun-stem *-skar-* has the same meanings that *-ndut-*, the stem of *on-du'-ta'* has, but it has a wider application in the modern vocabulary. There is no attempt made here to connect these stems etymologically, but a similar sematologic development only is shown in the two stems.

The stem of *ka skeⁿ'ra'* is *-skeⁿ'r-* or better *-skeⁿ'r-*. In the stems *-skar-* and *-skeⁿ'r-*, we have two generic noun-stems, having the same consonnatic sounds, sustaining one to the other the same positions in the two stems respectively, but differing in the interconsonantic vowel which vocalizes them. Nevertheless, it is assumed that these two stems are derived from one and the same proethnic source. It is clear that the stem *-skar-* is the older form, in that it is the simpler of the two. The change of the mid-stem vowel *a* to *eⁿ* is explained by the presence of the "interrupted explosive," represented by an apostrophe before a following *r* and by the presence of a *k* immediately before the vowel changed. The cause of the change was the "interrupted explosive," which became a part of the stem by analogic metathesis, a procedure which is not unknown in this language. So that there exists no formidable phonetic difficulty in the way of regarding the two stems *-skar-* and *-skeⁿ'r-* as derivatives from one and the same proethnic form, having the meanings possessed by the stem *-skar-*, already given above. Thus, it appears that *ka-skeⁿ'ra'* meant a mat or mattress; and this is the meaning which is absolutely required by the verb stem *-keq-te'* with which it is compounded.

Thus, both the compound-stems *-skeⁿ'ra keq-te'* and *-ndu-ta-keq-te'* were denotive of a custom of the Iroquoian warrior when on the war-path. The pronominal prefixes have been suppressed for brevity's sake. Prefixing the pronoun

of the third person masculine singular of the anthropic gender, *ro-*, to the first, we have *ro-skeⁿ'ra-keq-te'*, "he bears a mat on the back;" and *ho-*, a dialectic form of *ro-*, to the other we have *ho ndu-ta-keq-te'*, he "bears a mat on the back." So that in the baldest English a warrior was a "mat — or mattress — bearer," in the tongues of the Iroquoian peoples.

J. N. B. HEWITT.

Washington, D. C., March 15.

FORTHCOMING SCIENTIFIC BOOKS.¹

THE following is a list of scientific works which will be issued by various English publishers in the course of the spring: —

Messrs. Macmillan & Co. — "Essays on some Controverted Questions," with a Prologue, by Professor Huxley; "The Beauties of Nature," by Sir John Lubbock, F.R.S., illustrated; "Island Life, or The Phenomena and Causes of Insular Faunas and Floras," including a revision and attempted solution of the problem of geological climates," by A. R. Wallace, with illustrations and maps, new and cheaper edition; "The Apodidae," a morphological study, by Henry M. Bernard, illustrated (Nature Series); "Experimental Evolution," by Henry de Varigny; "The Diseases of Modern Life," by B. W. Richardson, F.R.S., new and cheaper edition; "The Geography of the British Colonies" — "Canada," by George M. Dawson, "Australia and New Zealand," by Alexander Sutherland (Macmillan's Geographical Series); "Scientific Papers," by Oliver Heaviside; "The Algebra of Co-Planar Vectors and Trigonometry," by R. B. Hayward, F.R.S., assistant master at Harrow; "Key and Student's Companion to Higher Arithmetic and Elementary Mensuration," by P. Goyen, inspector of schools, Dunedin, New Zealand; "Arithmetic for Schools," by Barnard Smith, late fellow and bursar of St. Peter's College, Cambridge, carefully revised in accordance with modern methods by W. H. H. Hudson, professor of mathematics, King's College, London; "Blowpipe Analysis," by J. Landauer, authorized English edition by J. Taylor and W. E. Kay of the Owens College, Manchester, new edition, thoroughly revised with the assistance of Professor Landauer; "Nature's Story Books," I., "Sunshine," by Amy Johnson, illustrated.

The Clarendon Press. — "Mathematical Papers of the late Henry J. S. Smith, Savilian Professor of Geometry in the University of Oxford," with portrait and memoir, two volumes; "Plane Trigonometry without Imaginaries," by R. C. J. Nixon; "A Treatise on Electricity and Magnetism," by J. Clerk Maxwell, new edition; "A Manual of Crystallography," by M. H. N. Story-Maskelyne; "Elementary Mechanics," by A. L. Selby; "Weismann's Lectures on Heredity," Vol. II., edited by E. B. Poulton, F.R.S.; "Epidemic Influenza," by F. A. Dixey.

The Cambridge University Press. — "A Treatise on the Mathematical Theory of Electricity," by A. E. H. Love, fellow of St. John's College, Cambridge, two volumes, Vol. I. in the press; "The Origin of Metallic Currency and Weight Standards," by W. Ridgeway, professor of Greek, Queen's College, Cork, and late fellow of Gonville and Caius College; "Solutions of the Examples in 'A Treatise on Elementary Dynamics,'" by S. L. Loney, formerly fellow of Sidney Sussex College, Cambridge.

Messrs. Longmans & Co. — "Darwin and after Darwin: an Exposition of the Darwinian Theory, and a Discussion of Post-Darwinian Questions," by George John Romanes, F.R.S., two volumes.

Messrs. A. & C. Black. — "Life in Motion, or Muscle and Nerve," a series of lectures delivered at the Royal Institution, Christmas, 1891, by John Gray McKendrick, F.R.S., illustrated.

Messrs. J. & A. Churchill. — "A Treatise on Hygiene," edited by Thomas Stephenson and Shirley F. Murphy, in two volumes, with numerous illustrations, Vol. I. nearly ready; "Chemical Technology, or Chemistry in its Applications to Arts and Manufactures," edited by Charles E. Groves, F.R.S., and William Thorp (with which is incorporated "Richardson and Watts's Chemical Technology"), Vol. II. "Lighting: Fats and Oils, Candles, Stearine, Gas, Electric Lighting;" "Materia Medica, Pharmacy,

¹ From Nature.

Pharmacology, and Therapeutics," by W. Hale White; "The Student's Guide to Diseases of the Nervous System," by J. A. Ormerod, with 66 illustrations; "A Dictionary of Psychological Medicine, giving the Definition, Etymology, and Synonyms of the Terms used in Medical Psychology, with the Symptoms, Pathology, and Treatment of the Recognized Forms of Mental Disorder, together with the Law of Lunacy in Great Britain and Ireland," in two volumes, edited by D. Hack Tuke.

Messrs. Whittaker & Co.—New volumes of the Specialists' Series—"Lightning Conductors and Guards," by Oliver J. Lodge, F.R.S., with numerous illustrations; "The Dynamo," by C. C. Hawkins and F. Wallis, with numerous original diagrams; "A Guide to Electric Lighting," by S. R. Bottone, for householders and amateurs, with 77 illustrations. Whittaker's Manual Instruction Series—"Manual Instruction: Woodwork," by S. Barter, Organizer and Instructor for the London School Board, and to the Joint Committee on Manual Training of the School Board for London, the City and Guilds of London Institute, and the Worshipful Company of Drapers, with over 300 illustrations; "Leather Work, Stamped, Moulded, and Cut, Cuir-Bouillé, Sewn, &c.," by Charles G. Leland, author of "Wood Carving," with numerous illustrations. Whittaker's Library of Popular Science—"Mineralogy," by Dr. F. Hatch, with numerous illustrations; "Chemistry," by T. Bolas with many illustrations.

Messrs. Sampson Low & Co.—"Answers to the Questions on Elementary Chemistry, Theoretical and Practical (Ordinary Course), set at the Examinations of the Science and Art Department, South Kensington, 1887 to 1891," by John Mills, two vols., fully illustrated; "Chemistry for Students, consisting of a Series of Lessons based on the Syllabus of the Science and Art Department, and specially designed to facilitate the experimental teaching of Elementary Chemistry in Schools and Evening Classes," by John Mills, numerous illustrations; "Decorative Electricity," by Mrs. J. E. H. Gordon, with a chapter on Fire Risks by J. E. H. Gordon, and numerous illustrations by Herbert Fell, engraved on wood by J. D. Cooper; "Examination of Soils," by W. T. Brannt.

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LETTERS TO THE EDITOR.

. Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Bacillus of Influenza.

IN consequence of the inaccuracy of two articles which have recently appeared in *Science* on the subject of the bacillus of influenza, the undersigned considers it necessary to give the following detailed abstract of the preliminary publications which have appeared this year in the *Deutsche Medicinische Wochenschrift* regarding the isolation and cultivation of this organism, and its relation to the disease.

The bacillus of influenza was no doubt observed by Babes in 1890, but he describes a variety of other organisms as occurring in influenza, and his communications^{1 2} show no more evidence than those of other authors of his having proved this or any other organism, to be peculiar to the disease. To the simultaneously published observations of Pfeiffer,³ Kitasato,⁴ and Canon,⁵ we must look for definite information on this subject, and to them most certainly is due the credit of discovery.

Where the bacillus of influenza is found. The bacilli are found in large numbers in the sputa and bronchial secretion of those who are suffering from influenza, and also to a greater or less extent in the blood. The bacilli in the sputa have been obtained in pure culture after a new method by Kitasato, and, according to Pfeiffer, their number in sputa bears a direct relation to the progress of the disease, the bacilli disappearing together with the purulent bronchial secretion. Pfeiffer suggests, in view of this fact, that the sputa be regarded as infectious material. This author examined the purulent bronchial secretion of thirty-one cases of influenza, and in all found the bacillus, which will presently be described. In uncomplicated cases of influenza pure cultures of the organism were obtained. He reports six autopsies, in two of which he obtained pure cultures. The bacilli occur in enormous numbers and frequently are observed in the pus cells. The examination of the lungs showed that the bacilli penetrate from the bronchi into the peri-bronchial tissue and may even attain the pleural surface, where, in two of the autopsies the bacilli were obtained in pure cultures from the exsudate on the surface of the pleura. In almost every one of twenty cases examined by Canon the characteristic bacilli were observed to be present in the blood (see further under staining). He usually found four to twenty isolated bacilli in each cover-glass preparation. In six cases where

¹ Babes, V., Vorläufige Mittheilungen ueber einige bei Influenza gefundene Bakterien (Feb. 17-May 3). Centralbl. f. Bakteriologie, 1890, vol. VII., pp. 233-241, 460-464, 496-502, 533-538, 561-568, 598-606 (with six photographs).

² Babes, V., Ueber die bei Influenza gefundene feinen Bakterien (Feb. 11). Deutsche Med. Wochenschr., 1892, No. 6, pp. 113-115.

³ Pfeiffer, R., Vorläufige Mittheilungen ueber die Erreger der Influenza (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, p. 28.

⁴ Kitasato, S., Ueber den Influenzabacillus und sein Culturverfahren (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, p. 28 (reported to the Society of Charité Physicians, Jan. 7).

⁵ Canon, P., Ueber einen Mikroorganismus im Blute von Influenzakranken (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, pp. 28-29.

the temperature of the patient had fallen, he found the bacilli in groups of five to fifty. In three of these six cases the temperature of the patient did not rise again after it had fallen, and the bacilli found at the time of the fall of temperature, or shortly after, disappeared after three to six days. The bacilli have not been observed in other conditions, as shown by many control observations made of the sputa in cases of bronchial catarrh, pneumonia, tuberculosis, etc., and they have never been demonstrated in the blood under other circumstances.

Diagnosis of Influenza by the microscopical examination of the blood in obscure cases. Canon¹ has been able to diagnose obscure cases of influenza, especially where no cough or expectoration existed, by means of the microscopical examination of stained blood preparations. The reliability of the microscopical examination was demonstrated in six cases by culture control experiments—the bacilli in the cover-glass preparations being but few and isolated.

Morphology. The bacilli are very minute non-motile rods, one-half as broad as they are long (of the same width as *B. murisep-ticus*, about 0.2μ) and occur in chains of three to four individuals.

Staining. The bacilli are stained by means of dilute Ziehl solution (carbolic acid, five per cent solution in distilled water, 100 cubic centimetres; alcohol, 10 cubic centimetres; fuchsin, 1 gram) or heated Löffler's methylene-blue, and, in consequence of the fact that the ends of the bacilli take up the stain more intensely than the rest of the organism (polar staining), they present the appearance, unless deeply stained (Canon), of diplococci when single, or of streptococci when several bacilli are united to form a chain. The bacilli do not stain well with basic anilins and the Gram method (Pfeiffer). They may be demonstrated in the blood of influenza cases as follows: A drop of blood flowing from the pricked finger tip, is brought in contact with a cover-glass and spread by means of a second cover-glass which is placed over the first. The cover-slips are then drawn apart, and we have two films of blood covering the surface of each, which we proceed to dry at room temperature. Place the cover-glass thus prepared five minutes in absolute alcohol, and from this into Czenzynke's solution (concentr. methylene-blue solution, 40 grams; one-half per cent eosin solution, in 70 per cent alcohol, 20 grams; aq. dest., 40 grams) for three to six hours at 37° C. On removal from the stain, wash with water, dry, and mount in balsam. This stain shows the red blood corpuscles red, the leucocytes and bacilli blue (Canon).

Cultivation of the bacillus of influenza. The bacillus requires 28° to 37° C. for its development. On 1.5 per cent sugar-agar Pfeiffer could not succeed in causing more than a second generation to grow, though minute characteristic colonies at first developed. On glycerine-agar Kitasato has succeeded in maintaining cultures alive up to the tenth generation. The colonies formed by the growth of the influenza bacillus on agar slant-cultures appear like minute watery drops, which are so small that they are easily overlooked. In a second culture, inoculated from the first, the tendency for the colonies to remain separate and distinct is more evident, this growth being regarded as perfectly characteristic. The colonies are observable by means of a hand-lens when 24 hours old.

In bouillon the growth at the end of 24 hours is poor, appearing first in the form of small particles suspended in the perfectly clear fluid. These small bacterial masses gravitate, forming a flocculent deposit and leaving the supernatant fluid clear. This mode of growth, as we know, shows them to be non-motile organisms.

Canon, in his first communication, stated that he had been unable to obtain a growth of the bacilli derived from the blood, either in bouillon, plain agar, sugar or glycerin agar. In his second publication² he describes a successful method he has employed for the isolation of the organisms. On account of the diminutive size of the colonies formed by the growth of the bacillus, their

comparatively small number in the blood, and the fact that the blood in coagulating prevents a proper isolation of the colonies, Canon proceeded as follows: The use of Esmarch roll cultures was abandoned in favor of cultures on Petri dishes. Into the latter, not only was it possible to introduce a larger amount of blood and thus increase the number of colonies obtained, but also such cultures offered the advantage of being readily examined for the minute colonies of the bacillus by means of the microscope. The blood of influenza patients was obtained in the usual way from the finger-tip, which had been sterilized with sublimate and dried with alcohol and ether, and pricked with a needle or pen-point previously sterilized in the flame. An assistant watches that the blood as it wells forth does not coagulate, but that the drops are spherical in form. Eight to ten drops are smeared over the surface of the dish, and the latter placed at 37° C. The colonies are best seen along the margins of the smeared blood ("Impfstrich"), or in places where relatively little blood has been smeared.

Pathogenic qualities. Monkeys and rabbits are susceptible when inoculated with this organism. Guinea-pigs, rats, pigeons (Pfeiffer), and mice (Pfeiffer, Canon) are refractory.

GEORGE H. F. NUTTALL, M.D., Ph.D. (Göttingen),

Assistant in Hygiene and Bacteriology.
Johns Hopkins University and Hospital,
Baltimore, Md.

The Question of the Celts.

It would interest me very much, and I believe it would many readers, if Dr. P. Max Foshay will adduce any positive evidence, linguistic, craniological, or artistic, to show, 1, That we have any means of deciding about the language of the Ligurians; 2, That the descent of the Auvergnats from the Ligurians can be traced; or, 3, That the Euskarian dialects are related to the Ural-Altaic group. According to Dr. Heinrich Winkler, probably the highest living authority on the Ural-Altaic languages, the Euskarian or Basque language has absolutely no relation to any member of the group.

D. G. BRINTON, M.D.
Philadelphia, March 29.

AMONG THE PUBLISHERS.

In the next number of *The Illustrated American*, No. 111, dated Saturday, April 2, will be commenced a series of illustrated articles by Professor Warren K. Moorehead, on the ancient and extinct race of people known as the Cliff Dwellers, formerly inhabiting that part of the country of the upper Colorado, the San Juan, and its tributaries. This scientific expedition has been sent out under the auspices of *The Illustrated American*. The progress and result of this expedition will be published from time to time in the columns of that excellent weekly.

— F. A. Davis, Philadelphia, has recently issued a book, by Hartvig Nissen, entitled "A B C of the Swedish System of Educational Gymnastics." Mr. Nissen is instructor of physical training in the public schools of Boston, and has been connected in a similar capacity with many of the leading educational institutions of this country and Europe. Since the Swedish system of educational gymnastics has been introduced into the public schools of Boston, it has become a necessity to have a practical hand-book, both for the teachers and the many homes where gymnastics are practised. It is with the purpose of giving plain answers to the most frequent questions that this book has been written.

— With the April number the *Review of Reviews* enters upon its second year. It has had an exceptional, if not an altogether unique, history. One year ago it was known only to a few discriminating readers, and its subscription list and news-stand sales required only a few thousand copies. Its edition the present month is 70,000 copies, and it is eagerly read in every State and Territory in the Union and in every part of Canada. No extraordinary efforts have been made to push the magazine. There has been very little canvassing done for it; no chromos have been given to its subscribers; no special inducements, such as an encyclopædia or a parlor organ thrown in as a gratuity or offered at half-price, have been offered by the publishers. The magazine

¹ Canon, P., Ueber Züchtung des Influenzabacillus aus dem Blute Influenzkranken (Jan. 21). Deutsche Med. Wochenschr., 1892, No. 3, p. 48.

² Canon, P., Ueber Züchtung des Influenzabacillus aus dem Blute Influenzkranken (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 3, p. 48.

has grown to an enormous circulation and to commanding influence simply upon its merits. Its readers have liked it and therefore recommended it to their friends. It owes not a little to the newspapers of the country, which have appreciated the journalistic enterprise and vigor and the enormous amount of hard, honest labor put into every number, and which have most heartily recommended it to their readers. While working in the closest co-operation with the English *Review of Reviews*, edited by Mr. W. T. Stead in London, the *American Review* is a distinct magazine, wholly and entirely edited, printed, and published in New York, and in the fullest sense of the word as much an American periodical

as Mr. Stead's London edition is an English periodical. The general aims and purposes, plans and methods, of the two magazines are identical, and each has the fullest access in advance to all the materials and illustrations prepared for the other. The *American Review*, being somewhat larger and higher priced, is more profusely illustrated. It has twenty or thirty more pages each month than the London edition. Its bound volumes, covering the past year, are a history of current action and thought, and a portrait gallery containing the faces of seven or eight hundred people of contemporary note, representing all parts of the world.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Mar. 26.—S. P. Langley, A Biographical Notice of General Meigs; Lester F. Ward, The new Psychology and what it Promises; T. Russell, River Stage Predictions.

Publications received at Editor's Office.

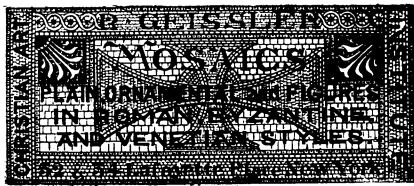
ADAMS, OSCAR FAY. The Presumption of Sex and other Papers. Boston, Lee & Shepard. 16°. 149 p. \$1.
BERNHARDT, WILHELM. Anderson's Bilderbuch ohne Bilder, with notes and vocabulary. Boston, D. C. Heath & Co. 16°. paper, 127 p. 35 cts.
BOTTONE, S. R. A Guide to Electric Lighting. New York, Macmillan & Co. 160°. 189 p. 75 cts.
BUTLER, N. M. The Place of Comenius in the History of Education. Syracuse, C. W. Bardeen. 16°. paper, 20 p.
CHENEY, SIMON PEASE. Wood Notes Wild: Notations of Bird Music. Edited by J. W. Cheney. Boston, Lee & Shepard. 12°. 276 p. \$2.
EVERETT, C. C. AND OTHERS. The New World: a Quarterly Review of Religion, Ethics and Theology. Boston, Houghton, Mifflin & Co. Vol. I. No. 1. 8°. 200 p. 75 cts. \$3 a year.
STORER, F. H. Agriculture in some of its relations with Chemistry. 4th ed. New York, Charles Scribner's Sons. 2 vols. 8°. pp. 561, 598.
SYME, DAVID. On the Modifications of Organisms. Melbourne, George Robertson & Co. 12°. 172 p.

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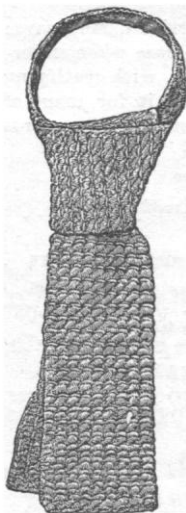
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